CLAIMS

1. In a microfabricated device comprising—

(1) a substrate containing a multiplicity of discrete and isolated regions arrayed across a surface thereof and adapted to interact with or integrally interacting with a detecting means capable of identifying and addressing each of said regions and determining and reporting the extent to which a binding reaction has taken place therein, and

(2) essentially homogeneous samples of biomolecules of pre-determined structures fixed in each of said discrete and isolated regions, such that the detection of a binding reaction between said biomolecules in one or more of said regions and a test sample provides information capable of identifying or otherwise characterizing the molecular species in said test sample,

the improvement that comprises:

discrete and isolated regions that extend through said substrate and terminate on a second surface thereof such that said test sample upon contact with said substrate is capable of penetrating therethrough during the course of said binding reaction.

2. The improvement according to claim 1 wherein said biomolecules are polynucleotides and said test sample comprises polynucleic acids.

3. The improvement according to claim 1 wherein said substrate is a nanoporous glass wafer.

4. The improvement according to claim 3 wherein said discrete and isolated regions are defined within said wafer by tapered conical wells extending to one face of said nanoporous glass wafer.

5. The improvement according to claim 4 comprising a high density array, wherein each of said discrete and isolated regions on said nanoporous glass wafer has a largest diameter of about 100 μm, the center-to-center spacing between adjacent regions is about 500 μm, said wafer is about 100 μm in thickness, whereby the volume of said conical well within the wafer is about 40 nL and the density of said regions on said wafer is about 400 regions/cm^2.

6. The improvement according to claim 4 comprising an ultra-high density array, wherein each of said discrete and isolated regions on said nanoporous glass wafer has a largest

diameter of about 50 μm, the center-to-enter spacing between adjacent regions is about 150 μm, said wafer is about 50 μm in thickness, whereby the volume of said conical well within the wafer is about one nL and the density of said regions on said wafer is about 4,400 regions/cm^2.

7. The improvement according to claim 4 comprising an array, wherein each of said discrete and isolated regions on said nanoporous glass wafer has a largest diameter of from about 5 μm to about 2000μm, the spacing between adjacent regions is from about 0.1 to 10 times said largest diameter, and said wafer is from about 10 μm to about 500 μm in thickness.

8. The improvement according to claim 1 wherein said substrate is a wafer comprising a nanochannel glass array, or a porous silicon array.

9. The improvement according to claim 1 wherein the contact between said test sample and said discrete and isolated regions is by flooding the first surface of said substrate with said test sample and placing said second surface of said substrate under negative pressure relative to said first surface, whereby the resulting vacuum facilitates the flow through said substrate.

10. The improvement according to claim 2 wherein said polynucleotides are fixed in said isolated and discrete regions on said substrate by attaching a terminal primary amine derivative of said polynucleotide to a glass substrate derivatized with epoxysilane.

11. The improvement according to claim 10 wherein said polynucleotide-silane fixation comprises the incorporation of one or more triethylene glycol phosphoryl units, whereby optimal spacing between said glass surface and the base pairs of said polynucleotide is achieved.

12. The improvement according to claim 2 wherein said oligonucleotides are fixed in said isolated and discrete regions on said substrate by attaching a terminal bromoacetyl derivative of said oligonucleotide to a platinum substrate derivatized with a dithioalkane.

13. The improvement according to claim 2 wherein said detection of said binding reaction is detection by a charge-coupled device (CCD) employed to detect hybridization of radioisotope-, fluorescent-, or chemiluminescent-labelled polynucleic acids.

14. A microfabricated device for simultaneously conducting a multiplicity of binding reactions, comprising:

(1) a substrate providing a rigid support for said device;

(2) an array of discrete and isolated regions arranged across a surface of said substrate and extending therethrough to a second surface of said substrate, thereby forming pores in said substrate;

(3) substantially homogeneous samples of a pre-determined set of biomolecules, each such sample being fixed in one or more of said regions, such that one or more of said biomolecules is capable of binding with a molecular species in a test sample passing therethrough; and

(4) a detection means capable of determining for each such region the extent to which a binding reaction has taken place and reporting the result thereof.

15. A device according to claim 14 further comprising a means for providing fluidic flow through the wafer.

16. A device according to claim 14 wherein said pre-determined set of biomolecules is a set of fully-degenerate oligonucleotides probes and said molecular species in said test sample are polynucleic acids.

17. In a method for using a microfabricated device for the identification or characterization of the molecular species contained in a test sample, said device comprising—

(1) a substrate containing a multiplicity of discrete and isolated regions arrayed across a surface thereof and adapted to interact with or integrally interacting with a detecting means capable of identifying and addressing each of said regions and determining and reporting whether a binding reaction has taken place therein, and

(2) essentially homogeneous samples of biomolecules of pre-determined structures fixed in each of said discrete and isolated regions, such that the detection of a binding reaction between said biomolecules in one or more of said regions and said test sample provides information capable of identifying the molecular species in said test sample,

the improvement that comprises:

allowing said test sample, during the course of said binding reaction, to penetrate through said discrete and isolated regions by constructing said regions to extend through said substrate and terminate on a second surface thereof.

18. The improvement according to claim 17 wherein said substrate is a wafer comprising a nanochannel glass array, a porous silicon array, or a cross-linked matrix of rigid synthetic

polymers.

19. The improvement according to claim 17 wherein the contact between said test sample and said discrete and isolated regions is by flooding the first surface of said substrate with said test sample and placing said second surface of said substrate under negative pressure relative to said first surface, whereby the resulting vacuum.

20. The improvement according to claim 19 wherein said biomolecules are oligonucleotides and said test sample comprises polynucleic acids.